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Docket 2535-CE-100  
Witness: Michael John Jaeger  
August 30, 2012

Public Service Commission of Wisconsin  
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**Ex.-PSC-Jaeger-1**

**PSC Staff Environmental Assessment**

**ENVIRONMENTAL ASSESSMENT**

**For the**

**Highland Wind Farm Project**

**Proposed by Highland Wind Farm LLC**

**Docket 2535-CE-100**

**July 18, 2012**

**Modified August 2012**

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## **1. Introduction**

This Environmental Assessment (EA) was prepared for an application by Highland Wind Farm, LLC (Highland) to construct a wind turbine electric generating facility in St. Croix County, Wisconsin. The purpose of this EA is to determine whether the proposed project warrants the preparation of an Environmental Impact Statement (EIS) under § 1.11, Wis. Stat. Highland's application, as supplemented with additional information provided by Highland in response to data requests, is the primary basis for the description of the proposed project. Other major sources of information are identified in the appropriate sections of this document.

The Commission promulgated a rule<sup>1</sup> to help establish uniform standards for the construction and operation of wind energy systems in Wisconsin by specifying what political subdivisions<sup>2</sup> can and cannot include in ordinances regulating wind energy systems (PSC 128 or wind siting rule). The restrictions apply to projects less than 100 MW. The Commission must also consider these restrictions when determining whether to grant a certificate of public convenience and necessity for projects 100 MW or greater, including the proposed Highland project. This EA includes information in relevant sections about how the proposed project compares to standards in the wind siting rule.

### **a. Project description**

Highland submitted an application to the Public Service Commission of Wisconsin (Commission) for authority to build about 41 wind turbines with associated service roads, electrical collector system, electric substation, and an operation/maintenance building. Highland proposes to construct the wind generation project in the towns of Forest and Cylon in St. Croix County; all of the proposed turbine sites are in the town of Forest, while the proposed substation site is in the town of Cylon.

The application states that the specific turbine model has not been selected. Three potential models are described (2.3, 2.4 and 2.5 MW models). Highland states that the information in the application generally describes a project configuration using 41 2.5 MW turbines. Project configurations of 42 (2.4 MW) or 44 (2.3 MW) turbines are also possible. The configuration consisting of 41 2.5 MW turbines is evaluated in this EA.

Highland proposes to construct, operate, and maintain 41 wind turbines with a total capacity of 102.5 MW. Highland has easements with landowners to host the proposed turbines and associated facilities. Each turbine would have the capacity to generate about 2.5 MW. The unit consists of a generator housing located atop a tubular steel tower about 328 feet tall and a three-bladed turbine. The turbine blade tips would reach about 493 feet above the ground. Highland has identified 41 preferred and 11 alternate turbine sites.

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<sup>1</sup> PSC ch. 128 Wis. Admin. Code, as required by 2009 Wisconsin Act 40.

<sup>2</sup> Political subdivisions are cities, villages, towns and counties.

The turbines would be located in an overall project area of approximately 26,500 acres. Highland has about 6,200 acres within the project area under easement for development. The turbines would be connected by underground electrical cables to an existing 161 kilovolt (kV) electric transmission line that traverses the western edge of the project area at a new substation.

#### b. Required state and federal permits and approvals

Highland submitted an application to the Commission for a Certificate of Public Convenience and Necessity (CPCN), as required by Wis. Stat. § 196.491 for proposed electric generation facilities of 100 MW or more. The Commission will decide whether to approve, deny or modify the project. To construct the proposed project, the applicant would also need approvals and permits from several federal and state agencies.

Highland submitted applications to the Wisconsin Department of Natural Resources (DNR) for permits that govern construction in and over waterways and wetlands (Wis. Stat. ch. 30 and ch. 281). As part of the DNR application process, Highland developed erosion control and storm water management plans. The proposed project is also subject to DNR review of potential impacts to endangered and threatened species and species of special concern (Wis. Stat. § 29.604).

The Wisconsin Department of Transportation (DOT) has reviewed the project for airspace concerns and issued permits related to construction of tall structures (Wis. Stat. § 114.135). DOT would also need to issue permits for transport of turbine parts (oversize and overweight vehicles) on state roads, as well as placement of access roads (driveways) and electric collector lines on state highway rights-of-way (Wis. Stat. § 86.07 and 86.16).

Several federal agencies have regulatory interests in the proposed project. The Federal Aviation Administration (FAA) reviewed the applicant's preferred turbine sites for airspace concerns and identified how the turbines would need to be marked and/or lighted. The applicant is consulting with U.S. Fish and Wildlife Service regarding potential impacts to federally protected species, including the bald eagle. An application for a permit from the U.S. Army Corps of Engineers to allow placement of fill in wetlands was submitted jointly with the DNR wetland permit applications. The U.S. Department of Commerce reviewed the proposed project and did not identify any potential concerns related to federal radio communication system interference.

#### c. Land rights acquisition

Highland is not a public or investor-owned utility and does not possess eminent domain statutory authority. Highland needs long-term easements for the land used for the wind turbines, access roads, and collector circuits. Temporary easements are also needed for crane paths, construction areas (such as widened access roads and turbine sites), and construction laydown areas for storing equipment and supplies. Highland possesses signed land owner agreements for the

parcels currently proposed to host all facilities for this project. Highland plans to purchase five acres of land on which the substation would be located.

#### **d. Public notification process**

Agendas and meeting minutes indicate that the Highland project was discussed at a number of town of Forest board and planning commission meetings during the years 2008 through 2010. The town of Forest claims that these meetings were not properly noticed and therefore town residents were not adequately informed of the proposed wind project.

In addition to meeting with project participants and discussions held during the township meetings, Highland held at least one public information meeting for all area residents in January 2011. Highland provided information to all residents of Forest Township through mailings, local newspapers, and website updates.

As required by statute, paper and electronic copies of the CPCN application were sent to local officials and libraries. The Commission sent a letter indicating its intent to prepare an Environmental Assessment (EA) to project area landowners and officials on April 26, 2012. The letter also solicited comments to help staff identify issues for the EA.

## **2. Project Need & Alternatives**

#### **a. Project need and cost**

The Commission's review of CPCN applications for merchant plants is more limited than for projects proposed by utilities. Under Wis. Stat. § 196.491(3)(d)2 and 3, a merchant plant CPCN applicant need not demonstrate that its facility would meet the reasonable needs of the public for electricity and the Commission may not consider economic factors when evaluating the application. The Energy Priorities Law ranks energy conservation and efficiency as its highest priority, but without information about need and project cost the Commission cannot determine the cost-effectiveness of the proposed project compared to energy conservation and efficiency and other sources of generation.

#### **b. Siting and site alternatives**

Highland states that it considered four project areas in addition to the proposed St. Croix County site when it was developing its proposed project. These project areas were located in east central Wisconsin, central Wisconsin and west central Illinois. The potential project areas were initially evaluated on their wind resource potential, access to large land parcels to enable placement of turbines, access to the electric transmission system, interconnection process and deliverability confidence, and overall constructability.

Highland further stated that each of these factors was researched, discussed, and weighed before additional work was done to further develop the proposed site. Highland states that the project is located in the town of Forest due to good wind resources and proximity to necessary transmission lines. Highland's application further states that the town of Forest has the lowest population density in St. Croix County, many of the town's residents are supportive of Highland's project, and the project area scores high for constructability.

As noted in Section 2a, the Commission may not consider economic factors when evaluating Highland's application. A meaningful comparison of alternate project locations is not possible without the ability to consider costs and economic factors. As a result, the alternate project locations described by Highland are not considered further in this EA.

The no action alternative, which would be a denial of Highland's application, is a potential outcome of the Commission's consideration of this application. The potential environmental consequences of the proposed project described in this EA would not occur if the Commission denies the application.

Within the proposed project area, Highland located wind turbine sites based on computer modeling of the wind resource, avoidance of water resources and woodlands, minimum distances from residences and roads, construction site accessibility, and a myriad of other factors. The setbacks used by Highland in placing turbines relative to occupied community buildings, participant and non-participant residences, participant and non-participant property lines, public road rights-of-way, and overhead communication and electric lines are consistent with setbacks described in the PSC 128 wind siting rules. Highland identified enough viable turbine sites to provide alternative locations for about 25 percent of its proposed turbines.

The project area is generally homogeneous, predominantly a mixture of agriculture and small woodlands. The primary differences between wind turbine sites are distances to residences and woodlands, and whether the sites can be accessed from other turbine sites or directly from roads.

If the project is approved, individual turbine sites and associated facilities would be more precisely located as engineering and consultation with landowners proceeds. Highland states that it has generally addressed the siting uncertainty by providing information to the Commission and DNR for the maximum potential environmental impact that could occur. While the proposed turbine locations could change slightly, the overall change in environmental effect would likely be minimal.

### 3. Project Design

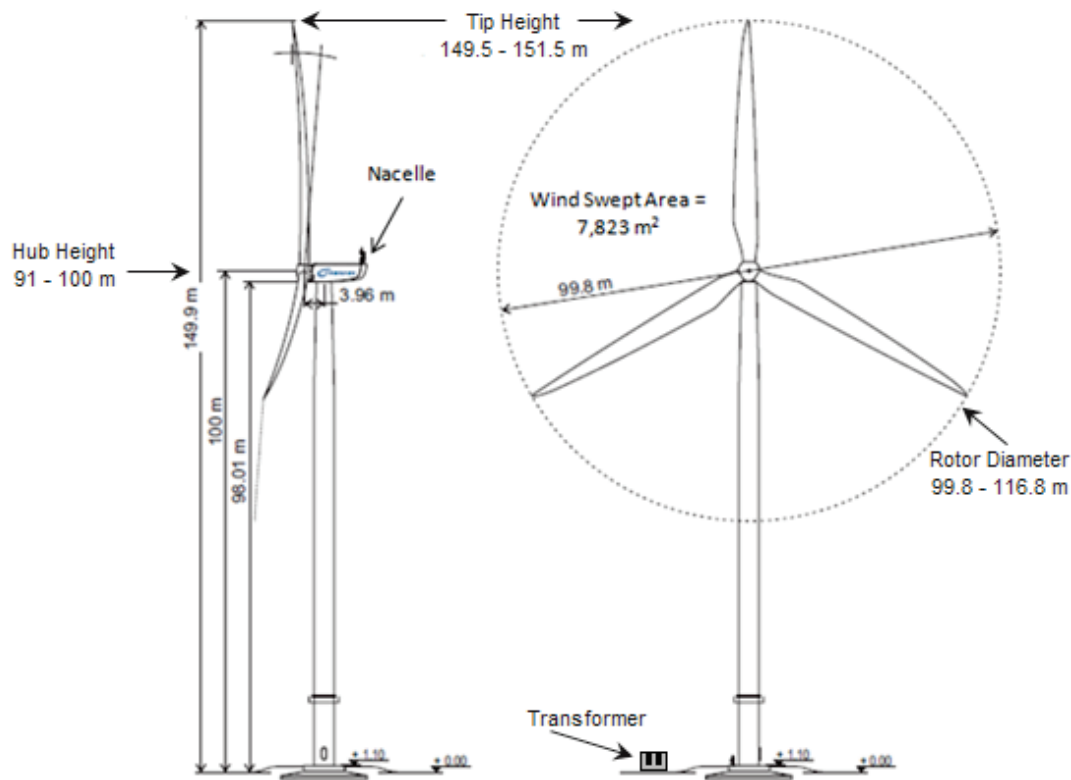
#### a. Wind turbine and turbine pads

Highland has not chosen a final turbine design, but provided information about a range of turbine sizes that may be used (additional turbine models may be considered). The physical characteristics do not differ appreciably. The three turbine models described in the application are summarized in Table 1. Turbine design would not affect the amount of land needed for construction of facilities. The area permanently affected at each turbine site would cover about 0.15 acres and include a gravel area around the turbine and an area for a crane to work. In addition, the transformer, which converts turbine voltage to collector system voltage, is sometimes located near the base of the turbine (or alternatively, in the turbine nacelle). Highland estimates that the amount of additional land that would be temporarily used for construction would be about 1.4 acres per site.

**Table 1**      **Alternate turbine characteristics**

<b>Manufacturer</b>	<b>Nordex</b>	<b>Nordex</b>	<b>Siemens</b>
Model	N100/100	N117/91	SWT-2.3-113
Rated power (megawatt)	2.5	2.4	2.3
Hub height (feet)	328	299	312
Blade length (feet)	161	187	180
Total Height (feet)	493	491	497
Cut in wind speed (miles per hour)	6.7	6.7	6.7
Cut out wind speed (miles per hour)	44.7	44.7	56.0
Operational RPMs	7.5 – 13.2	6.0 – 13.0	9.6 – 14.8
Rated wind speed (miles per hour)	26.8	24.6	28.0

**Figure 1**      **Side and front views of turbine site (from Highland's application)**



#### b. Access roads, crane paths and laydown area

About 11.5 miles of gravel roads would be constructed to provide access to turbine sites from public roads or other turbine sites. On a permanent basis, Highland estimates these roads would be about 16 feet in width. During construction, the width would likely increase an additional 40 feet to allow the passage of the large erection crane, as well as installation of electrical collector lines, storage of displaced soil, and use as laydown areas. Where access roads intersect public roads, the public roads may need to be temporarily or permanently widened to allow for the turning radius of large vehicles.

The cranes needed to assemble the wind turbines would use access roads between turbine sites or travel cross-country because they cannot use public roads. Crane paths that are not adjacent to access roads would be 40 feet wide. Because cranes typically cannot traverse slopes greater than about 12 percent, temporary ramps may have to be built for any public road crossings or at other barriers.

Construction of access roads would require soil removal and compaction, and the addition of aggregate or other materials to stabilize the soil. No additional aggregate is expected to be necessary for the crane paths.

A construction laydown area of about 20 acres would be located near the operation and maintenance building site. Materials and equipment would also be stored at turbine sites and along access roads.

### c. Collector circuits and substation

Energy produced by each turbine would be transformed to a voltage level of 34 kV by transformers located at each turbine. Collector circuits would carry this energy to a central substation, which would convert the voltage level from 34 kV to 161 kV. The substation would be interconnected to the existing transmission grid via an existing 161 kV line. Highland has applied to the Midwest Independent Service Operator (MISO) for interconnection to the electric transmission grid. As part of the process, MISO will prepare studies of the effect of the proposed project on the existing transmission system.

As currently proposed, the substation would be located on the east side of 250<sup>th</sup> Street, approximately 4,000 feet south of Polk St. Croix Road/240<sup>th</sup> Avenue. The existing 161 kV transmission line, to which the substation would be interconnected, is located along 250<sup>th</sup> Street. Highland would purchase a five-acre parcel for development of the substation, which would have an approximate footprint of 480 feet by 185 feet (just over two acres). The final designs of the substation and interconnection equipment are contingent upon the results of the MISO studies.

Each turbine would be connected to the substation by a collector circuit. A total of four circuits are proposed, each connected to 10 or 11 turbines and carrying approximately one-quarter of the project generating capacity. The circuits would generally be separate at individual turbine locations and converge as they move toward the substation. As currently proposed, all four circuits would converge at 220<sup>th</sup> Avenue and 270<sup>th</sup> Street and share a 4.5 mile route into the substation.

All collector circuits would be located underground, primarily along turbine access roads and public roads. Each collector would be buried about four feet deep. The horizontal space needed would depend on the number of circuits installed together. A width of approximately two feet would be needed for a single collector circuit and increase to about 12 feet where all four collector circuits are side by side. The amount of land disturbed by installing the collector circuits would also depend on the installation method used. Using open trenching techniques would disturb a wider area than if a vibratory plow installation method were used. Highland proposes to install collector circuits using horizontal direction drilling in environmentally sensitive areas (e.g., waterways and wetlands) to reduce surface disturbance and impacts to these resources.

#### d. O&M building

The operations and maintenance (O&M) site would support a permanently staffed operations building. The building would require utility services. A well would be drilled to supply water and a private septic system would be installed. The site would include an employee parking lot and outdoor storage yard. About 6 to 8 full-time employees would work in the building.

#### e. Construction sequence and schedule

Highland estimates that construction of the wind farm would require 220 days to complete. The process would start with final engineering design and procurement of electrical system components. Actual construction would commence with the O&M building, which would temporarily serve as construction offices. Highland provided an estimate of the overall amount of time required for various project components: 96 days for civil construction; 89 days for foundation construction; 66 days for turbine erection; 80 days for collection system construction; and 90 days for substation construction. Some construction activities would be completed concurrently. The date of project commencement would be dependent upon Commission and other permit approvals as well as turbine availability and delivery. As such, Highland has requested that the Commission grant a two-year period in which construction could begin in the event that the CPCN application is approved.

Highland estimated the amount of time needed for different construction activities at a typical turbine site, as outlined in Table 2. Some of these activities would be completed concurrently. The timeline considers only active construction at a site, and does not take into account the time required to move cranes from site to site (one to four days) or other gaps in construction that may occur.

**Table 2 Estimated time required to complete construction at a typical turbine site**

Construction Activity	Days at Site
Access road and collection system installation	5
Foundation preparation (excavation, steel grid and anchor bolt assembly, concrete foundation pouring and curing)	46
Backfilling, compaction, grading and gravel fill around tower foundation	3
Tower erection and turbine assembly	2
Electrical wiring	2
Soil decompaction and site restoration	2

#### 4. Potential Impacts (including proposed mitigation & restoration)

Commission staff used the Geographic Information Systems (GIS) data provided by Highland to estimate the number of participating and non-participating residences at various distances from one or more wind turbines. The results of this analysis are included in the following table.

Number of Turbines Within One-Quarter Mile	Non-Participating Residences	Participating Residences
1	5	8
2	0	3
<b><i>Total Residences</i></b>	<b>5</b>	<b>11</b>

Number of Turbines Within One-Third Mile	Non-Participating Residences	Participating Residences
1	42	13
2	2	4
3	0	1
<b><i>Total Residences</i></b>	<b>44</b>	<b>18</b>

Number of Turbines Within One-Half Mile	Non-Participating Residences	Participating Residences
1	70	9
2	28	9
3	10	4
4	1	1
<b><i>Total Residences</i></b>	<b>109</b>	<b>23</b>

### a. Aesthetics

Because the proposed wind turbines are about 500 feet tall and would be visible for long distances, the visual character of the project area would change if the proposed project is built. The effect of that change depends on individual perception. A number of factors such as the location of the proposed turbines relative to the onlooker, the onlooker's activity, and the presence of any screening objects, such as hills or trees, can influence how the new wind turbines are perceived.

The proposed wind farm is located in a rural area. Highland has said that it intends to locate all turbines on property of willing landowners. It is expected that participating landowners (those with turbines on their property) would have less concern with the potential visual impact of the new turbines than nearby, non-participating landowners.

The presence of the new turbines would likely, for some residents in the project area, be considered a major degradation of the area's visual landscape, affecting the quality of life for those individuals, especially if they enjoy the relatively undeveloped agricultural landscape.

Highland's application addresses the visual impact of the wind turbines from public lands, such as roads and parks. Highland hired a consultant to create photo simulations representing how the wind turbines would appear from various vantage points within the project area.

The consultant's photo simulation report focused on eight locations from which to gauge the change in scenery. These locations were chosen based on turbine sites and sensitive resources in the area. Submitted photo simulations were views near parks, churches, cemeteries, turbine clusters and well-travelled highways, such as CTH P and STH 64. The report did not address the change in view at individual residences in the project area.

Locations from which pictures were taken include the town of Forest ball park near 270<sup>th</sup> St. and STH 64, churches on STH 64 and 210<sup>th</sup> Ave., and the town of Forest Cemetery. The simulations are meant to give a general impression of the potential change in views, not an exact picture. The photos provide a sense of the relative scale of the proposed wind towers compared to the existing environment. The photos generally show several turbines at a distance or in the middle ground of the view.

The only known public recreation area in the project area is the town of Forest ball park. No other public areas in the project area are known for their views, such as parks with scenic overlooks. The view from the town ball park would include multiple turbines, but they do not appear to dominate the view, given their distance from the park

The Federal Aviation Administration (FAA) has standards for marking and lighting wind turbines. The FAA indicated that turbines at all of the 52 sites would have to be white and 37 of

them would require synchronized flashing red lights. The turbines that would have to have red lights installed are generally located on the outer edge of a cluster of turbines, while inner turbines in a cluster generally only need to be white. No daytime lighting would be needed under the FAA standards if the turbines are white. The flashing red lights would be very conspicuous at night in the open rural setting of the project area.

#### **b. Agricultural resources**

Agriculture is the predominant land use within the project area, comprising approximately 66 percent (17,605 acres) of the total land cover. Cropland in the project area is cultivated for cereal grains, row crops, hay and alfalfa. Some land is used for pasture, and small tracts of old or fallow field also exist within the project area.

##### Lands Removed from Production

Temporary loss of approximately 60 acres of cropland and 29 acres of hay, pasture or fallow lands would occur during project construction. These impacts would result from movement of construction vehicles and cranes, installation of the collector system, and equipment staging at the substation and each turbine. Additionally, a temporary construction vehicle parking and laydown area would impact approximately 20 acres of cropland. Highland states in its application that agricultural land temporarily impacted by the project would be restored to pre-construction condition. Restoration methods would include stripping, segregating and replacing topsoil, and repairing any soils compacted by heavy loads.

Agricultural land within the footprints of wind farm facilities would be permanently converted to non-productive use, including approximately six acres for turbine pads, 21 acres for access roads, and three acres for the substation and O&M building. Additionally, productivity of lands near facilities may decline from possible erosion, mixing of soil horizons, and disruption to existing drainage patterns. These long-term impacts would primarily be mitigated through monetary compensation, as dictated by agreements between Highland and landowners.

##### Farmland Preservation and Conservation Reserve Program Lands

Two proposed turbine sites are located on lands with farmland preservation agreements, managed under the St. Croix County Farmland Preservation Plan. These lands would be released from the farmland preservation program. While the landowners would no longer receive benefits under the preservation agreements, they would not be required to repay past benefits.

Four proposed turbine sites are located on lands enrolled in the U.S. Department of Agriculture Conservation Reserve Program (CRP), which offers financial incentives to landowners who participate in the conservation of eligible environmentally valuable lands. Wind turbine construction could affect the eligibility of these lands to remain enrolled in the program. Any

compensation for loss of CRP payments or penalties assessed by the USDA would be best addressed in the easement agreements between Highland and landowners.

#### Farm animal disturbance

Like people living in the project area, farm animals would be exposed to lights, noise and shadow flicker created by wind turbines. Exposure levels would depend primarily on where the animals reside relative to turbines. Concerns have been raised that farm animals could be negatively affected when wind turbines are operated nearby. Commission staff is not aware of specific scientific studies of the potential effects of turbine lights, noise and shadow flicker on animals. Rather, information regarding the effects of wind turbines on livestock health consists primarily of anecdotal observations. Similar to the reaction of some humans, some animals may become stressed or annoyed by wind turbine facility operations.

#### Livestock and Stray Voltage

Stray voltage is a term used by the Commission to describe a physical phenomenon that may affect confined livestock, primarily dairy cows. Approximately 30 farms with confined animal operations are located in the project area.

Electrical systems—including localized farm systems and utility distribution systems—by code must be grounded to earth to ensure continuous safety and reliability. However, even when the system is wired and grounded properly, some current can flow through the earth at each grounding point and cause a small voltage (less than 10V) to develop. This type of voltage is called neutral-to-earth voltage (NEV) and is a common occurrence in electrical systems. When livestock simultaneously come into contact with two points at which NEV is present, such as at metal troughs or stall dividers in a barn, a small current can flow through the livestock which may cause a behavioral response. This phenomenon is referred to as stray voltage.

The proposed project is unlikely to create stray voltage problems in the project area. Stray voltage is associated primarily with distribution systems, including both utility distribution systems and localized farm systems. The proposed project would not connect directly to any distribution systems or change electrical service at farms in the project area. Transmission systems can induce voltages and currents on distribution systems through high electric and magnetic fields if the systems are in close proximity. However, the proposed substation would connect to an existing 161 kV transmission line and no new transmission lines are proposed. Finally, the grounding system for the proposed underground electric collector system could generate currents from which stray voltage could be created. Proper design of the collector system, however, would mitigate potential stray voltage impacts.

### c. Airports

No public use airports are located within the project boundary. The closest public use airports to the project area are the Amery Municipal Airport, about 6 miles to the northwest and the Boyceville Municipal Airport, about 7.5 miles southeast of the project boundary.

No private use airfields are registered with either the Federal Aviation Administration or the Wisconsin Department of Transportation within the project area.

The FAA has reviewed the proposed locations of the 52 turbine sites identified by Highland. The FAA has issued Determinations of No Hazard to Air Navigation for each of the potential turbine sites, assuming that the turbines are appropriately painted and lighted.

The Wisconsin Department of Transportation Bureau of Aeronautics has also issued Tall Structures Permits for the 52 possible turbine locations.

No effects on airspace or airport use are expected from the proposed turbines.

### d. Archaeological and historic resources

Wisconsin Historical Society (WHS) databases were reviewed to identify the presence of any known cultural or historic resources that may be affected by the proposed project.

Based on the distances of known archaeological sites from areas of proposed ground disturbance and the relatively low density of recorded sites within the project area, no impacts to archaeological resources would be anticipated.

A cemetery associated with Immanuel Lutheran Church is located on the north side of 210<sup>th</sup> Avenue, less than 400 feet from the proposed access road for turbine WTG-18. However, as the proposed access road and turbine are located on the south side of 210<sup>th</sup> Avenue, construction activities would not impact the cemetery.

No direct impacts to recorded historic structures would occur from construction of the proposed project. However, views from these properties may change if the project is approved and turbines are constructed.

### e. Community impacts

#### Local Ordinances and Permits

Wis. Stat. § 196.491(3)(i) guarantees that projects requiring a CPCN may not be precluded or inhibited by local ordinance. The applicant may acquire county permits for transporting heavy and oversized loads on county roads and locating facilities within county ROWs. Highland has secured permits for driveway access to St. Croix county highways. The substation area would require re-zoning from agricultural to agricultural residential with a special exemption permit

issued from St. Croix County. Highland would construct the substation driveway in accordance with the town of Cylon ordinances.

In 2010, the town of Forest issued turbine site and driveway permits to Highland. At that time, the project was designed for less than 100 MW and did not require a CPCN from the Commission. All town permits have been rescinded.

The St. Croix County land use plans, development plans, and zoning ordinances contain no limitations on wind development. In late 2011, the town of Forest passed two ordinances, a wind energy systems licensing ordinance (August 11, 2011) and an interim zoning preservation land use ordinance (December 29, 2011) that would prevent the construction of Highland. While neither of these local ordinances applies to this project, they are a means to gauge the community's issues and concerns. Additionally, these ordinances may not be in compliance with the newly revised Wis. Stat. § 66.0401(1m) which prohibits municipalities from enacting wind siting ordinances more restrictive than the PSC 128 wind siting rules. The current town board has stated that the Highland wind project, as proposed, poses significant health and safety risks to the community and is not in the public interest.

#### Community Agreements

On August 12, 2010, the town of Forest signed a Wind Development Agreement with Highland. In 2011, the town of Forest rescinded the agreement due to findings of improper public notice and procedures by the former town board. Highland states that it intends to adhere to almost all of the terms and conditions of the former Wind Development Agreement, in addition to the former permits issued for the project. The agreement specifies payments to residences located within one-half mile of a turbine. The only item in the agreement that would not be met by the applicants is the payment to the town of Forest and St. Croix County, as these government entities would be compensated by shared revenue (see Section 4r).

Community and wind developer agreements traditionally work to resolve outstanding issues. There are no plans between the town of Forest and Highland to negotiate a new community agreement. The town of Forest is a party to this docket.

#### Complaint Resolution Process

Highland states that it would establish a complaint process consistent with the process described in section PSC § 128.40 of the wind siting rules. Furthermore, in regards to noise and shadow flicker complaints, Highland proposes a call-in number, recordkeeping of all complaints, expeditious resolution, and the establishment of a local complaint committee for those matters not successfully concluded by the applicant.

Comprehensive Plan of the town of Forest

The town of Forest's Comprehensive Plan, adopted in 2009, incorporates and prioritizes several key issues identified in a community survey conducted prior to finalizing the plan. The Plan's Vision Statement talks about the desire to maintain scenic open spaces for its residents, to plan development in a manner that considers and finds balance with the natural resources and rural character and to promote appropriate commercial and industrial development in the Hamlet of Forest, which is roughly the area in the vicinity of the intersections of STH 64, STH 63 and County Trunk D. The protection and promotion of farming, forestry practices, and other natural resources are also highlighted in several sections of the plan. In addition, under a heading titled Energy and Sustainability, the Comprehensive Plan includes an objective to "Adopt renewable energy policies and practices as part of a strategy to meet future energy needs" and states that "The town will encourage all forms of renewable energy projects, including wind, solar and bioenergy."

Construction of the proposed 41 500-foot tall turbines, whose sites are scattered throughout the township, would change the existing aesthetics and visual character of the town of Forest. It would also be inconsistent with the stated desire to concentrate commercial and industrial development near the town's business center and major roads.

Alternatively, the proposed project would not result in the loss of significant agricultural or forest land or impede farming or forestry practices. It also appears to be consistent with the renewable energy objectives stated in the plan.

Finally, a 10-acre area was mentioned as a preferred location for a future town of Forest park that would include an area for fishing and picnicking. This area is currently owned by a landowner who has signed an easement with the applicant and it is unclear whether construction of the project would prohibit future park development.

#### f. Decommissioning

The community could be impacted by improper decommissioning of the wind project when it is no longer maintained or producing energy. Highland estimates that the design life for the project is approximately 30 years. Highland proposes to restore the land to pre-construction (or equivalent) condition as agreed to by participating landowners. Turbine towers and foundations would be removed to four feet below grade. Underground collection cables would be cut off and left in place. Typical restoration activities include placement of fill with soils similar to the surrounding area, grading to nearby land contours and planting with appropriate vegetation.

Highland would post a letter of credit with the town in the amount of \$391,000 for the purpose of decommissioning. The application also contains, from Michels Corporation, salvage estimates between \$100,000 and \$150,000 for a single turbine and a dismantling cost of approximate \$134,000 per turbine. Highland believes that in 30 years, salvage rates would increase faster than deconstruction costs. It is not possible to accurately predict labor, equipment, and salvage pricing past 2012 and therefore not possible to know if the letter of credit would be sufficient to

properly decommission the project at the end of its useful life. The town has questioned the applicant's conclusions regarding project decommissioning.

#### g. Electromagnetic fields

Electromagnetic fields (EMF), both electric and magnetic, are created when an electric current flows through a conductor, occurring wherever and whenever electricity is used. Electric fields produced by wind turbines and the associated collector circuits are negligible. Magnetic fields are the focus of this section. Magnetic field levels vary in intensity depending on how much electric current is flowing at any given time; generally, higher electrical currents correspond with larger magnetic fields.

The underground 34.5 kV collector circuit system would be the primary source of magnetic fields in the proposed project. Highland and its contractor performed an analysis of potential magnetic field levels that could be found in varying segments of the collection system. The model assumed conductors would be installed at a depth of four feet. Where two or more circuits are installed together, the model assumes some horizontal separation between the circuits. Approximately 3.5 feet of total width was assumed for two circuits, eight to ten feet for three circuits, and 10 to 12 feet for four circuits. The magnetic field sensor was modeled at one meter above ground (the approximate center of mass for an average person).

Table 3 demonstrates the magnetic field output of the collector system at representative configurations. The maximum magnetic field levels would be within approximately four feet of the trench centerline and decrease rapidly with distance from the trench. The highest magnetic field level would be found at the centerline of a single circuit with feeds from 11 turbines. Lower magnetic field levels are expected for collectors with fewer turbine feeds or with multiple circuits. Where there are multiple circuits the circuits would be separated and arranged (transposed) so that the magnetic fields between the circuits are partially cancelled. See Table 3 for the estimated magnetic field profiles of representative segments of the collector system.

**Table 3: Estimated magnetic field profiles of representative collector system segments**

Number of Circuits/Turbine Feeds in Trench	Calculated Magnetic Field Levels (mG) at Varying Distances from Centerline of Trench			
	0 feet	25 feet	50 feet	100 feet
4 circuits / 41 turbines	41.03	7.70	1.84	0.45
3 circuits / 31 turbines	42.70	8.17	2.02	0.50
2 circuits / 21 turbines	36.39	3.73	0.99	0.25
1 circuit / 11 turbines	104.56	7.77	2.05	0.52

1 circuit / 6 turbines	57.05	4.24	1.12	0.28
1 circuit / 3 turbines	28.64	2.13	0.56	0.14
1 circuit / 1 turbine	9.50	0.71	0.19	0.05

For comparison, microwave ovens can generate between 10 and 30 mG at a distance of two feet, refrigerators can generate up to 20mG at a distance of one foot, and hair dryers can generate between 300 and 700 mG at a distance of six inches.<sup>3</sup>

#### h. Land use and land cover

Highland calculated existing land uses in the project area, as summarized in Tables 4 and 5. Within the project area, agricultural land accounts for approximately two-thirds and wooded areas account for approximately one-quarter of the total land use.

Table 5-2 represents an estimate of the types and amounts of land that would be occupied by proposed wind farm facilities, both temporarily and permanently. Temporary acreage includes areas that would be disturbed during construction but restored following construction. Acreages designated as being permanently affected would support wind turbines, access roads or related facilities for at least 20 to 30 years. The vast majority of land that would be temporarily or permanently impacted by wind farm facilities is agricultural.

**Table 4: Existing land use in the project area**

<b>Agricultural</b>	<b>Woodland</b>	<b>Wetlands/ Waterways</b>	<b>Developed (buildings &amp; roads)</b>	<b>Total</b>
66%	25%	5%	4%	100%
17,605 acres	6,550 acres	1,260 acres	1,135 acres	26,550 acres

<sup>3</sup> “Electric and Magnetic Fields,” National Institute of Environmental Health Sciences, accessed May 24, 2012, <http://www.niehs.nih.gov/health/topics/agents/emf/index.cfm>.

**Table 5: Approximate acreage (temporary and permanent) occupied by proposed facilities**

Facilities	Agriculture		Woodland		Wetlands/ Waterways		Developed		Total	
	<i>Temp.</i>	<i>Perm.</i>	<i>Temp.</i>	<i>Perm.</i>	<i>Temp.</i>	<i>Perm.</i>	<i>Temp.</i>	<i>Perm.</i>	<i>Temp.</i>	<i>Perm.</i>
Turbine pads and equipment staging	55	6.2	--	--	--	--	--	--	55	6.2
Access roads	0.5	21.4	--	0.3	--	0.2	4.0	0.5	4.5	22.4
Crane paths	31	--	--	--	0.3	--	0.4	--	31.7	--
Collection system	2.5	--	--	--	--	--	8.0*	--	10.5	--
Substation	0.5	2.0	--	--	--	--	--	--	0.5	2.0
O&M building and parking	--	0.5	--	--	--	--	--	--	--	0.5
Construction laydown area	20	--	--	--	--	--	0.1	--	20.1	--
<b>All facilities</b>	109.5	30.1	--	0.3	0.3	0.2	12.5	0.5	<b>122.3</b>	<b>31.1</b>

\* This figure assumes an eight foot wide surface disturbance to install the collector circuits along public roads. In those locations where multiple collectors are installed side-by-side, a wider surface disturbance is likely, suggesting this estimate may be too low.

#### i. Lighting

Most construction is expected to occur during daylight hours. Supplemental nighttime lighting, however, may be required if work at night is necessary to meet project schedules. If work does occur after dark, mobile trailer lighting systems and generators would likely be required to ensure safe work conditions.

The Federal Aviation Administration (FAA) has standards for marking and lighting wind turbines. The FAA has reviewed the proposed locations of the 52 potential turbine sites identified by Highland. The FAA indicated that the turbines at all of the 52 sites would need to be white and 37 of them would require synchronized flashing red lights. The turbines that would have to have red lights installed are generally located on the outer edge of a cluster of turbines, while inner turbines in a cluster generally only need to be white. No daytime lighting would be needed under the FAA standards if the turbines are white. The flashing red lights would be very conspicuous at night in the open rural setting of the project area. The turbine locations that would require nighttime aviation obstruction lighting could change based on the final project design.

#### k. Noise

Wind turbine noise is typically produced by both mechanical and aerodynamic sources. Mechanical noise is created by bearings, gear housings, cooling fans, yaw drives, and the generator

itself. The tower and nacelles may also conduct or transmit mechanical noise. The mechanical noises are generally emitted at tonal frequencies associated with rotating machinery.

Aerodynamic noise is created when turbine blades pass through the air. Aerodynamic noise levels are affected by wind speed and the design of the turbine. The flow of air over the rotating turbine blades is not smooth, resulting in turbulence and noise. Aerodynamic noise is broadband in character, meaning that the noise occurs over a wide frequency range.

Noise is also generated during construction of wind turbines. Construction noise would come from a series of intermittent sources, most of which would be diesel engine construction equipment. Because of the unique nature of large-scale wind projects, the construction phase would be spread over a large area. Construction noise impacts would vary significantly with time of day, stage of construction, and turbine location. Construction of access roads and foundations, and turbine component and crane deliveries, are likely to be the loudest sources of construction noise. Construction would occur primarily during daytime hours, so there would be little or no construction noise impact at night.

The types of noise generated by construction of the wind farm are not expected to be significantly different from noises associated with other common outdoor construction activities. Thus, the remainder of this section focuses on turbine aerodynamic and mechanical noises.

Highland hired a consultant to conduct a noise study as required by the PSC Noise Assessment Measurement Protocol (Noise Protocol). The study involves measuring ambient noise for ten-minute intervals at six locations in the project area during various time periods throughout the day. Highland's consultant also conducted continuous sound level measurements at two locations. The Noise Protocol requires the applicant to provide a sound level contour map showing the anticipated sound levels from the proposed project. These sound levels, in conjunction with measurements of existing sound levels, are used to estimate the potential increase in noise levels in the project area.

In order to determine the likely impact of a new noise source it is important to understand how new sources of sound add to the ambient environment. Sound levels are logarithmic rather than linear. This means that the decibel levels emitted by two different sound sources cannot simply be arithmetically added together to determine the combined effect of those sound sources. As a generally accepted rule of thumb, two noise sources emitting sound at the same dBA level (a commonly used sound level measurement) would have a combined total sound level of 3 dBA greater than either source alone.

As a point of reference, sound experts generally agree that the human ear can detect changes in dBA roughly as follows:

- A change of 3 dBA or less is barely perceptible.

- A change of 5 dBA is perceptible.
- A change of 10 dBA is perceived as either twice or half as loud.

Sound levels decrease with distance from the source. Assuming there are no obstructions between the sound source and receptor, the sound from a single point source decreases by approximately 6 dBA for every doubling of the distance. For a sound source that is a continuous line, such as a highway, the sound levels will generally decrease by about 3 dBA with a doubling of the distance from the source. In addition to distance, sound levels can be affected by intervening structures or objects such as buildings, trees, and shrubs.

Based on the modeling results, turbine operation would be audible within the project area. The analysis performed by Highland's consultant indicated that noise from the proposed project would not be expected to exceed 50 dBA under worst-case conditions at any existing non-participating residence.

Noise levels associated with wind turbines are difficult to assess because of the scattered nature of the turbines. In addition, impacts largely depend on the distance to and number of nearby turbines, the sensitivity of individuals (receptors), wind speed and direction, time of year, the type of structures or vegetation existing between the turbine and the receptor, and turbine design. Ambient sounds, including natural sounds, may also mask turbine noise to some degree.

Concern has been raised for every recent Wisconsin wind turbine project regarding the potential effects of noise on people living in the project area. Noise can be a significant annoyance to people, as noted by complaints from residents living near recently constructed wind projects. Sleep disturbance appears to be a common concern. It has been suggested that exposure to wind turbine noise can result in other major health problems, including psychological distress, stress, anxiety, depression, headaches, fatigue, tinnitus, and hypertension.

The Minnesota Department of Health in 2009 reviewed the literature on wind turbine noise effects and concluded that:

The most common complaint in various studies of wind turbine effects on people is annoyance or an impact on quality of life. Sleeplessness and headache are the most common health complaints and are highly correlated (but not perfectly correlated) with annoyance complaints. Complaints are more likely when turbines are visible or when shadow flicker occurs. Most available evidence suggests that reported health effects are related to audible low frequency noise. Complaints appear to rise with increasing outside noise levels above 35 dBA. It has been

hypothesized that direct activation of the vestibular and autonomic nervous system may be responsible for less common complaints, but evidence is scant.<sup>4</sup>

The Massachusetts Department of Health and Department of Environmental Protection issued a report in early 2012 from an independent expert panel review of wind turbines and health.<sup>5</sup> The report concludes that there is limited evidence from epidemiologic studies suggesting an association between noise from wind turbines and sleep disruption. The report further states that, while not based on evidence of wind turbines, there is evidence that sleep disruption can adversely affect mood, cognitive functioning, and overall sense of health and well-being.

Furthermore, there is insufficient evidence that the noise from wind turbines is directly (i.e., independent from an effect on annoyance or sleep) causing health problems or disease.

The Massachusetts report also addressed the theory advanced by Dr. Nina Pierpont, stating that her claims regarding infrasound from wind turbines directly impacting the vestibular system have not been demonstrated scientifically. In addition, it concludes that there is no evidence to support characterizing the set of health effects identified by Dr. Pierpont as constituting a “Wind Turbine Syndrome.”

Some nearby residents may be disturbed or annoyed by wind turbine noise from the proposed project. Sleep disturbance, as previously noted, is likely the most important potential consequence to these individuals. Predicting how many people, or who specifically, are likely to be disturbed is not possible. For people who might be disturbed or annoyed by wind turbine noise, the presence of new turbines could represent a substantial reduction in their quality of life.

Concerns were submitted during the EA comment period about potential effects on autistic individuals. As discussed further at the end of Section 4q, individuals with autism spectrum disorders can have heightened sensitivity to changing stimuli in their surroundings. Noise produced by wind turbines could be unusually noticeable or distressing to individuals with increased sensitivity to auditory stimuli.

Pre-construction sound levels in the Highland project area appear similar to pre-construction sound levels in other wind project areas in Wisconsin. Acceptability standards for noise vary by nation, state, and locality. In the U.S., the federal Environmental Protection Agency provides noise guidelines, not standards. Some state governments issue their own regulations and local governments often enact noise ordinances.

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<sup>4</sup> Minnesota Department of Health, Environmental Health Division, “Public Health Impacts of Wind Turbines” (paper prepared for the Minnesota Department of Commerce, Office of Energy Security, 2009), 29.

<sup>5</sup> Massachusetts Department of Health and Department of Environmental Protection, “Wind Turbine Health Impact Study: Report of Independent Expert Panel, January 2012, 63.

The PSC 128 wind siting rule includes limits that can be adopted for wind turbine noise. Specifically, the limits, cited in PSC § 128.14 Wis. Admin. Code, are that turbine noise cannot exceed 50 dBA during daytime hours and 45 dBA during nighttime hours at non-participating residences or occupied community building.

The noise modeling performed by Highland shows that while expected noise levels from all turbines would be consistent with the 50 dBA daytime threshold in the wind siting rules, estimated noise levels at many non-participating residences are above the nighttime 45 dBA threshold. The noise modeling was done for three potential turbine models. The following table shows the number of non-participating residences for which the modeling indicated worst-case noise levels of between 45 and 50 dBA.

**Table 6. Estimated Number of Non-Participating Residences with Nighttime Noise Levels Exceeding 45 dBA**

	<b>Total</b>	<b>45.1-46.0 dBA</b>	<b>46.1-47.0 dBA</b>	<b>47.1-48.0 dBA</b>	<b>48.1-49.0 dBA</b>	<b>49.1-50.0 dBA</b>
Nordex N100/100	45	18	18	7	2	0
Nordex N117/91	27	18	7	2	0	0
Siemens SWT-2.3-113	20	16	4	0	0	0

Highland’s consultant stated that the actual noise levels at any given location are expected to be less due to the conservative assumptions used in the model.

The most recent utility scale wind farm reviewed by the Commission was the Glacier Hills project proposed by Wisconsin Electric Power Company (WEPCO). The EA prepared for that project concluded that the preparation of an EIS would be helpful, in part, because:

“Noise can be a significant annoyance to people, as noted by complaints from residents living near wind turbines that are part of recently constructed wind projects. Sleep disturbance appears to be common concern. It has been suggested that exposure to wind turbine noise can result in other significant health problems, including psychological distress, stress, anxiety, depression, headaches, fatigue, tinnitus and hypertension.”

“While the current level of knowledge regarding potential health effects from turbine noise is limited and does not allow conclusions to be drawn regarding specific health effects, a

more in-depth discussion of some of the literature regarding this potential impact may be helpful to the decision-makers for this project and to the general public.”<sup>6</sup>

The EIS prepared for the Glacier Hills project in September 2009 included references to the 2009 Minnesota study noted earlier in this section. The Glacier Hills EIS stated that:

“The studies done to date suggest that there is a wide variability in how people react to wind turbine noise and that many people do not appear to be affected. The studies do, however, support the concern that some people do react negatively to wind turbine noise, primarily through annoyance and sleep disturbance. It is widely accepted that disruption of sleep can lead to other physiological and psychological problems.”<sup>7</sup>

The 2012 Massachusetts study discussed earlier in this section had not been released at the time the Glacier Hills EIS was prepared. The main conclusions from the Massachusetts study are consistent with and reinforce the evaluation contained in the Glacier Hills EIS.

The estimated noise levels for the Glacier Hills project were generally similar to the levels estimated for Highland’s project. In both cases, the project applicants designed their projects to achieve a noise level lower than 50 dBA at non-participating residences. The Commission required WEPCO to reduce nighttime noise levels at Glacier Hills to below 45dBA at a residence if the occupants complained about turbine noise. The Commission did not specify the specific technique WEPCO would have to use to reduce nighttime noise levels at Glacier Hills. Potential methods that can reduce turbine noise levels include curtailing or modifying of the operation characteristics of specific turbines during nighttime hours.

## I. Property values

Residents in the project area have expressed concerns that construction of the proposed wind turbines would reduce their property values due to changes in views, rural character and land use in the township, and because of noise, shadow flicker and perceived possible health effects. In recent years a number of studies have been done to evaluate the effect of utility-sized wind turbines on property values. However, weaknesses in the study designs make it difficult to apply the conclusions of these studies to a specific project in a different locale. Factors complicating the search for cause and effect relationships between wind turbine facilities and property values include the short period of time that most wind farms have been in operation, the small number of arms-length homes sales near operating turbines, and the recent downturn in the economy.

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<sup>6</sup> Wisconsin Public Service Commission, Environmental Assessment, Glacier Hills Wind Power Project Proposed by Wisconsin Electric Power Company Docket 6630-CE-302, Modified June 2009, page 29 (PSC REF# 115840)

<sup>7</sup> Wisconsin Public Service Commission, Final Environmental Impact Statement, Glacier Hills Wind Park Project, PSC Docket 6630-CE-302, Volume 1, September 2009, Page 82 (PSC REF# 120688)

For example, a large study conducted by the Berkeley National Laboratory found no evidence that home prices surrounding wind facilities are consistently, measurably, and significantly affected by either the view of wind facilities or the distance of the home to those facilities. However only about one percent of the homes out of the 4,937 post-construction sale transactions modeled were located less than 3,000 feet from a turbine, with another one percent of the homes located between 3,000 feet and one mile away.<sup>8</sup> In addition to the very small set of close-by sales transactions, the study has been criticized due to the inclusion of a large number of transactions involving homes at a great distance from wind facilities and without views, or only minor views, of turbines.

Because the permanent impacts on agricultural properties that host wind turbines would be relatively small once construction and restoration are complete, these properties would likely retain their value for farming purposes and have a guaranteed annual source of income from the turbines for the life of the project.

On a long-term basis, improper or incomplete decommissioning of the proposed project could adversely affect local property values. Decommissioning is usually addressed through property easements, community agreements, and/or Commission order conditions. Though there is a disagreement whether the Wind Development Agreement between the Town of Forest and EEW is in force, Highland has stated it would honor the original decommissioning plan. To this end, Highland would post a letter of credit with the town in the amount of \$391,000. Additional discussion of decommissioning is found in Section 4f.

#### m. Television, radio and telecommunications interference

Wind towers can block or cause unwanted reflections of broadcast signals, causing interference with television reception. If any television interference would be reported and determined to be caused by the proposed project, Highland states that the television interference “would be mitigated so as to provide the same level of coverage prior to the installation of the wind turbine facility.” Mitigation options generally include installation of high-gain television antennas, cable television, wireless television distribution systems, or satellite television.

Wind turbines can also cause interference with telecommunications, including cellular communications, radio broadcast and wireless internet. Highland states in its application that it would conduct a pre- and post-baseline evaluation of cellular communication service in the immediate project area. If mobile phone coverage impacts are discovered, Highland would mitigate the impacts by improving existing cellular antenna sites or adding new cell sites. To avoid interference with radio broadcast signals, the proposed turbine sites are located farther than the minimum recommended distances from AM and FM station antennas. Wireless internet

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<sup>8</sup> B. Hoen, R. Wiser, P. Cappers, M. Thayer, and G. Seth, “The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Hendonic Analysis,” *Ernest Orlando Lawrence Berkeley National Laboratory*, December 2009.

customers may lose reception if wind towers are located directly in signal paths. Highland states that it would work with internet service providers “to find a practical solution that resolves a challenge found to be the direct result of a wind turbine(s).”

Wind turbines can interfere with microwave paths by blocking the beam path between microwave transmitters and receivers. Highland contracted a study of microwave paths in all of St. Croix County; 54 paths were identified, none of which intersect with the proposed turbine locations.

#### n. Recreation

A baseball field in the town of Forest is located in the general area of multiple proposed turbines, the nearest of which would be approximately 1,500 feet northeast. The proposed wind turbines would not directly impact use of the ball field. However, views from the park would be affected. No other recreation facilities would likely be directly or indirectly impacted by the proposed project.

The Town’s Comprehensive Plan identified a 10-acre area on private property that was a preferred location for a future Town of Forest park that would include opportunities for fishing and picnicking. Several proposed wind turbine sites are located on that property.

#### o. Roads

Traffic would increase in the project area during construction due to commuting workers, truck delivery of materials and equipment, and delivery of the turbines themselves. Approximately 100 commuting workers are likely to enter the project area from all directions and they would park on land acquired for the operations & maintenance building and laydown yard. The estimate for truck deliveries is 3,900 truck trips. The turbine components would be carried by over-size and over-weight trucks. About eight to ten of these oversize trucks are needed per turbine, or 300 to 400 trucks for the entire project. The source and travel route of the turbine components is not yet known.

Increased and oversized traffic loads on the narrow local roads would cause some minor traffic congestion. Traffic control actions would be employed as well as avoidance of peak travel times to minimize potential impact. Traffic control actions along county and state highways would be handled by the contractor using standard practices.

Construction of the wind farm could damage town roads and possibly county roads. Highland hired a consultant to conduct a preliminary review of the status of area roads, bridges, and culverts. The consultant advised a more detail level of review and assessment of roads, bridges and culverts after Highland determines delivery routes. Smaller road intersections along delivery routes and intersections with access roads would be widened during construction, in order to allow for wide turns from oversize trucks and construction equipment.

Additionally, Highland has committed to a pre-construction survey of county and local road conditions within the project area. Roads would be video-taped before and after construction and assessed by an independent consultant acceptable to the county and townships of the project area. Direct damage resulting from the project would either be repaired to pre-construction conditions or the affected jurisdiction would be compensated for the damage. Highland has stated that mitigation of damaged roads would be mutually agreed upon by Highland and the affected jurisdictions. However, there is no current agreement between the township and Highland regarding the procedure for determining damages to local roads.

Trees along equipment delivery routes may require additional pruning to accommodate the large loads. Trimming or clearing of trees on participating landowners' property would be agreed to between the property owner and Highland.

#### p. Safety and emergency Plans

The safety of area residents has not been a problem for those living near or within existing wind farms. There are guidelines, training, and safety standards for workers building or maintaining turbines.

Safety devices are built into wind turbines to protect against parts failure. These devices would shut the turbine off if vibration or speed becomes excessive. Lightning protection systems are also installed on turbines. Mechanical failures, involving blade loss and fires do occur, however these occurrences are rare. Similarly, the safety risks associated with the potential of ice throw from turbine blades is also low.

Hazardous materials including fuel for vehicles, paints, and lubricants would be stored on-site during construction. A Spill Prevention, Containment, and Countermeasures (SPCC) plan would be kept on-site during construction.

Emergencies may occur during the operation of the proposed wind farm facilities. Section 128.18(4) of the wind siting rules describes a cooperative approach to emergency plans and a notification of local first responders in the event of an emergency. Highland states it is prepared to meet the signage, emergency planning requirements, and all other applicable items in section 128.18(4) of the wind siting rule if the project is approved.

Local overhead electric distribution lines are located throughout the project area. These lines might interfere with construction equipment and trucks hauling turbine components. For these deliveries, pole stands that lift the line above the truck may be employed eliminating the need for line disconnection. In other locations, "line drops" may be used. For a line drop, the local electrical service is disrupted for a brief time and the line is temporary rerouted underground for a short distance. Where line drops or pole stands are not practical, the expected outage for a material delivery would be 10 to 15 minutes.

Some distribution lines may also intersect with cross-country crane paths. These distribution lines would most likely need to be disconnected for approximately 20 to 30 minutes for the passage of the crane. Line drops to minimize disruptions to the electrical service may also be used for passage of cranes.

In the event that distribution service needs to be interrupted, Highland states in its application that it would coordinate the interruption with the local distribution company and municipal officials and would notify local residents.

#### q. Shadow flicker

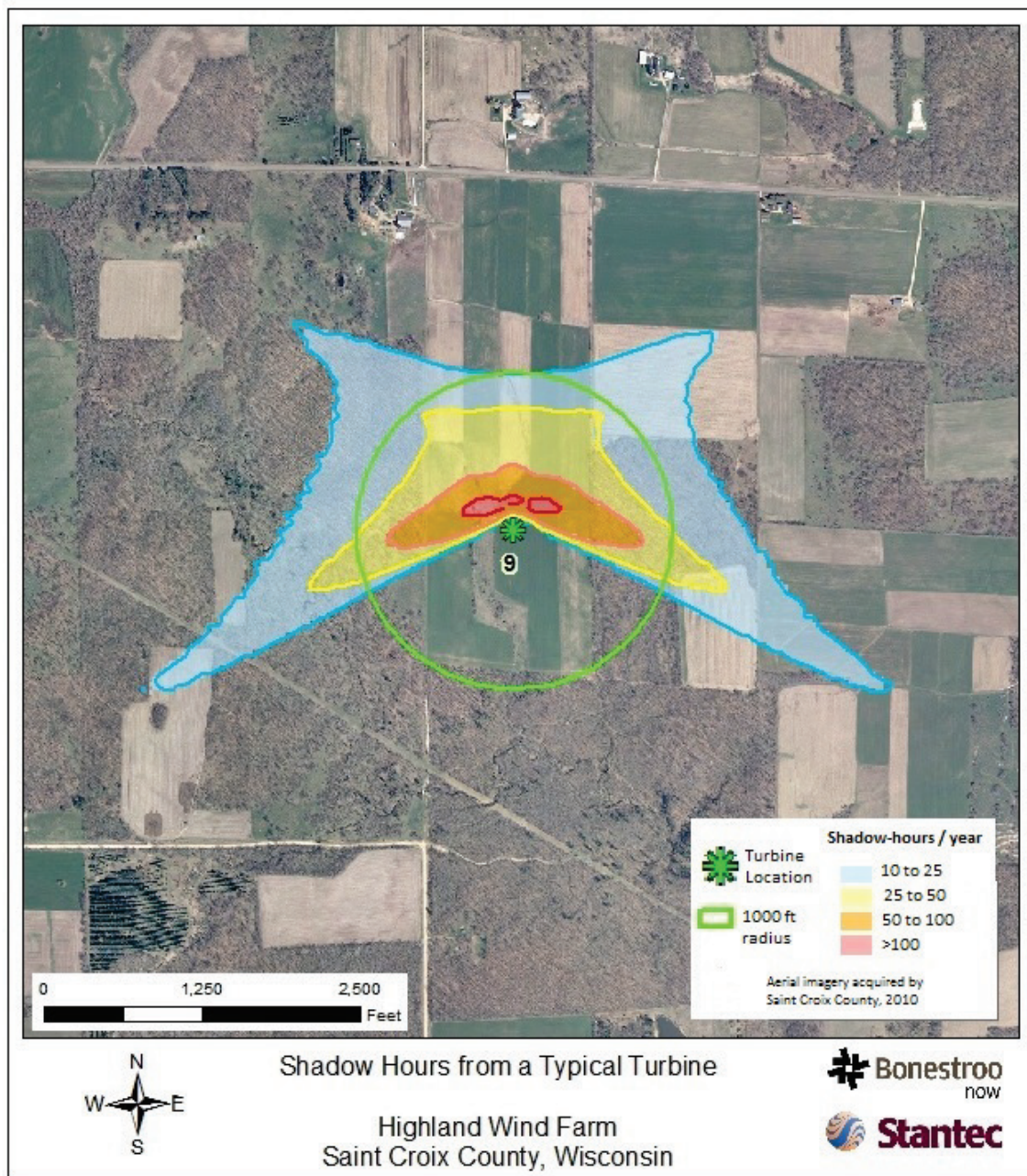
Due to their height, wind turbine structures can cast shadows on wide areas around them. An area within the shadow of rotating turbine blades can experience rapid changes in light intensity (i.e., a strobe effect from rapidly alternating direct sunlight and shadow). This effect is referred to as shadow flicker.

The intensity, amount and duration of shadow flicker impacts are determined by the distance and direction from the receptor to the turbine. Generally, a receptor located to the northeast, northwest, southwest or southeast of a turbine would have the greatest potential to be impacted by shadow flicker. The number of hours of shadow flicker experienced annually tends to diminish with greater distance between a receptor and turbine.

Atmospheric conditions can also influence the potential for shadow flicker to occur. Shadow flicker occurs only during hours of sunshine, as no discernible shadows are cast on overcast days. No shadow flicker occurs when turbine rotors and blades are still, such as when winds are calm. Wind turbines are designed to turn and face into the wind, creating wide variances in the orientation of the blades to the sun and receptors. Consequently, shadow flicker impacts to any given receptor can increase or decrease as wind direction changes.

Figure 2 demonstrates the location and duration of shadow flicker impacts that would occur around a typical turbine in the project area.

**Figure 2 Shadow Hours from a Typical Turbine**



Generally, the modeling results show that a house to the south of a turbine would not be impacted and that houses farther away from a turbine would have fewer hours of impact. With the exception of short midday impacts in the winter due to low sun angles, the results also show that impacts on houses 1,000 feet away from a turbine would be limited to early morning and late afternoon, when the sun angle is low and shadows tend to be more diffuse.

Shadows from moving turbine blades can cause pulsing light effects inside a home, creating an annoyance for residents. Individual reactions to shadow flicker varies greatly; some individuals

may be extremely annoyed while others experience little distraction. It is likely that some non-participants will experience shadow flicker from the proposed project and may consider the new shadow flicker a major impact on their quality of life.

The PSC 128 wind siting rules include a limit of 30 hours per year of shadow flicker at a nonparticipating residence or occupied community building. If this limit is exceeded under normal operating conditions, the project owner would be required to use operational curtailment to reduce the number of shadow flicker hours. The rules also include a 20 hour per year limit that, if exceeded, would require other forms of mitigation by the project owner.

Highland evaluated shadow impacts by using conservative inputs and industry accepted modeling software. The software calculates potential number of hours of shadow flicker at a given location using the positions of turbines and receptors, typical climatic conditions and the position of the sun throughout the year. Potential shadow flicker impacts were modeled for all three turbine types (2.5 MW, 2.4 MW and 2.3 MW). Based on the modeling for the preferred 2.5 MW turbine, four non-participating residences could experience between 30 and 40 hours of shadow flicker annually and 17 non-participating residences could experience over 20 hours per year. For comparison, the 2.4 MW model could cause between 30 and 40 hours of shadow flicker for 12 non-participating residences and between 20 and 30 hours for 14 non-participating residences.

Highland indicated that if “mitigation of shadow impact is necessary, Highland will work with the resident to provide an acceptable solution.” Options that Highland identified to mitigate the effects of shadow flicker include installing shades and blinds in windows affected by shadow flicker, planting trees or shrubs to block wind turbine shadows, or curtailing turbine operation during times when residents are affected. Highland states that it can provide residents with detailed studies of potential shadow flicker impacts on their homes, including days, times, and duration of potential impacts.

Concerns about the potential of the proposed turbines to affect area epileptic or autistic residents were raised during the EA comment period.

Studies have indicated that shadow flicker from wind should not cause problems for epileptics. Epileptic seizures can sometimes be triggered by certain frequencies of flashing or flickering light sources; this is a condition known as photosensitive epilepsy. The World Health Organization estimates that at any given time, the proportion of the general population with active epilepsy is between 4 and 10 per 1,000 people.<sup>9</sup> A small percentage of those with epilepsy experience photosensitive epilepsy; children and adolescents are more likely to be affected by photosensitivity than adults aged mid-twenties and older. The frequency of flashing light most likely to trigger a seizure varies from person to person. The frequency range of

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<sup>9</sup> “Epilepsy Fact Sheet No. 999,” World Health Organization, last modified January 2009, <http://www.who.int/mediacentre/factsheets/fs999/en/index.html>.

greatest concern has been defined in some literature as between 5 and 30 flashes per second (Hz),<sup>10</sup> while other sources identify a more limited range of 16 to 25 Hz.<sup>11</sup> It is uncommon for photosensitivity to be triggered by frequencies less than 3 Hz. Shadow flicker frequencies from the proposed wind turbines would be less than 1 Hz.

A wide body of scientific literature exists about sensory sensitivity in people with autism spectrum disorders (ASD). The National Autistic Society reports that many people with ASD “have difficulty processing everyday sensory information such as sounds, sights and smells,”<sup>12</sup> and the Center for Disease Control and Prevention reports that “[p]eople with an ASD might have unusual responses to touch, smell, sounds, sights, and taste.”<sup>13</sup> In some cases, one or more senses in individuals with ASD can be over-reactive to stimuli.<sup>14</sup>

For wind turbine farms, issues with sensory sensitivity in people with ASD are primarily related to visual and auditory stimuli. Noise produced by wind turbines could be unusually noticeable or distressing to individuals with increased sensitivity to auditory stimuli. Some individuals may also react to the visual stimuli of rotating blades on turbines and resulting shadow flicker. However, individuals with ASD vary widely in their responses to stimuli, and reactions to wind turbines would be difficult to predict.

#### r. Shared revenue and other local economic benefits

Under Wis. Stat. 79.04(06), local municipalities are paid annually for generation that is located within their boundaries. The payment set by statute is \$2,000 per MW, annually. St. Croix County would receive two-thirds of the total payment and the town of Forest would share one-third of the total payment.

In addition to the payment for generation, there is an annual incentive payment for renewable generation. That payment would be \$1,000 per MW annually to the county and to the town.

Highland proposes to use turbines with nameplate capacities of 2.3, 2.4, or 2.5 MW. Because Highland has not yet chosen a turbine size, Table 7 shows the total annual payments that would be paid to the county and township based on the three turbine capacities.

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<sup>10</sup> “About Epilepsy,” The Epilepsy Foundation of America, accessed May 24, 2012, <http://www.epilepsyfoundation.org/about/photosensitivity/index.cfm>.

<sup>11</sup> “Photosensitive Epilepsy,” Epilepsy Action, last updated March 2012, <http://www.epilepsy.org.uk/info/photo.html>.

<sup>12</sup> “The Sensory World of Autism,” The National Autistic Society, accessed May 25, 2012, <http://www.autism.org.uk/15691>.

<sup>13</sup> “Autism Spectrum Disorders Signs and Symptoms,” Center for Disease Control and Prevention, accessed May 25, 2012, <http://www.cdc.gov/ncbddd/autism/signs.html>.

<sup>14</sup> “Sensory Integration,” Autism Research Institute, accessed May 25, 2012, [http://www.autism.com/index.php/symptoms\\_sensory\\_overview](http://www.autism.com/index.php/symptoms_sensory_overview).

State statute sets a limit on the generation payment (but not for the incentive payment) based on the population of the political subdivision. The county limit for the generation-related payments is \$100 per person and the township limit is \$200 per person. Highland's payments, to the county nor the township, would not exceed these limits.

The shared revenue payments for qualified general structures, other than the turbines would be based on the net book value of the facilities. The only general structure not located within the town of Forest is the proposed substation which would be sited in the town of Cylon. The Department of Revenue is the responsible agency for determining the amount of shared revenue to be paid to local jurisdictions if the Commission approves the project.

The towns and county would receive the first shared revenue payments the year after the project becomes operational and they would continue until the facility is decommissioned.

**Table 7      Total estimated annual payments to St. Croix County and Town of Forest\***

<b>Turbine Capacity (MW)</b>	<b>Number of Turbines</b>	<b>Total Proposed MW</b>	<b>St. Croix County</b>	<b>Town of Forest</b>
2.3	44	101.2	\$236,133	\$168,667
2.4	42	100.8	\$235,200	\$168,000
2.5	41	102.5	\$239,167	\$170,833

\* At this time the amount of shared revenue payment to the town of Cylon for the substation is unknown

The construction of the project would require approximately 100 skilled workers. Preference would be given to Wisconsin-based businesses and workers. During construction the influx of workers would provide economic benefits to local businesses in the form of housing/lodging, food service, fuel, etc.

Post-construction, the wind project would require an ongoing staff of 6 to 8 factory-trained technicians.

#### **s. Waterways and wetlands**

Highland submitted a wetland delineation report for areas in which project facilities would be located. The report identified ten wetland areas, including one singular wetland feature and three wetland complexes containing nine different wetlands. The report classified the wetlands as emergent wet meadow, scrub/shrub or forested, and described their current land uses as farmed wetlands, pasture land or man-made agricultural drainage ditches/windrows. The wetlands in pasture land and agricultural ditches are reportedly dominated by invasive and weedy species (e.g., reed canary grass, Canada thistle, Kentucky blue grass, and box elder), and farmed wetland areas are cultivated for crops. None of these wetlands have been designated by the DNR as outstanding or exceptional waterways or areas of special natural resource interest.

No wind turbines would be constructed within waterways or wetlands, but permanent access roads would cross waterways and wetlands. Access roads would be 16 feet wide and constructed using geotextile fabric overlaid by crushed gravel. Access roads would permanently impact approximately 0.14 acre of wetlands. Some access roads would be temporarily widened to accommodate crane passage, which would temporarily impact 0.22 acre of wetlands. Access roads would also cross six intermittent streams, none of which have been designated by the DNR as areas of special natural resource interest. In order to maintain water flow and minimize impacts, Highland proposes to install metal corrugated culverts at these six crossings.

Cross-country crane paths used during the construction phase would result in temporary impacts to wetlands and waterways. Crane paths would be approximately 40 feet wide and would be prepared by vegetation removal, with no grading required. Highland proposes to use timber mats and temporary clear span bridges (TCSBs) in areas where cranes would cross wetlands and waterways. TCSBs are currently proposed for seven intermittent stream crossings.

In areas where the underground collector cable system would cross wetlands and waterways, Highland proposes to use horizontal directional drilling (HDD). Use of the HDD method avoids disturbance to the waterways and streams and minimizes the likelihood that the proposed project would affect water quality.

Highland submitted applications to the DNR for wetland water quality certification and other applicable permits under Chapter 30, Wis. Stats. The DNR permits would dictate the specific crossing method for each waterway or wetland and specify any additional requirements to protect these resources, including timing of construction, erosion control measures, setbacks, additional temporary work space locations, in-stream sediment control, equipment bridges, and substrate backfill specifications.

Overall, the proposed project's potential impacts on waterways and wetlands are expected to be minor. The waterways that would be crossed are generally small and intermittent, and the total area of wetlands that would be affected is relatively small. Most of the wetlands have been degraded by the establishment of weedy and invasive species, and no rare wetland species are known to be present.

#### t. Wildlife

Potential wind farm impacts to birds and bats include collision mortality, habitat loss, and habitat fragmentation. The severity and significance of the impact can be greater for rare and declining species.

#### Turtles

A review of the state's Natural Heritage Inventory identified that the state threatened Blanding's turtle has been recorded near the project area. Blanding's turtles prefer shallow marshy habitats

with abundant submerged vegetation, although they can be found in almost any aquatic habitat. They are semi-terrestrial and often move between wetlands during the active season. Suitable Blanding's turtle habitat could be present in the project area.

Like other turtles, Blanding's are susceptible to being killed by cars and other vehicles. This is particularly true during the nesting season when females are moving to and from nesting sites.

A variety of construction practices can be followed to reduce potential Blanding's mortality. Construction during the species' hibernation period from 1 November to 1 April can greatly reduce potential mortality. Using exclusion fencing is another approach designed to keep the turtles out of active construction areas. Finally, identifying and restricting construction activities in suitable Blanding's habitat can reduce disruption of hibernation areas and death from being hit by vehicles.

### Birds

The data and conclusions available from existing modern wind projects are insufficient to understand the interaction of birds, environmental factors and wind turbines. Three wind farm projects in Wisconsin have had both pre and post-construction bird studies. Bird mortality rates evaluated at several other upper Midwest wind farm projects suggest that losses in the range of one to eight birds per turbine per year might be expected. Preliminary numbers from wind farm sites in Wisconsin are at the upper end of this range. Losses at these levels are not likely to be significant to populations of most common bird species.

A wind farm project proposed in an area harboring endangered, threatened, or other rare species would raise a greater concern. Likewise, construction of wind turbines near areas with concentrated bird use, or along heavily used local flight paths, would also be a greater potential concern. Indirect affects to birds through removal and fragmentation of habitat can be a concern depending on the types of habitat present in a project area.

Highland started a one-year pre-construction bird use study of the project area in late May 2011. The results of that study through late December 2011 were submitted in the application.<sup>15</sup> The bird use study continued and ended in May 2012, enabling a collection of one full year of data. The point count methodology used and the timing of the survey was consistent with the Breeding Bird Survey methodology and provides a general assessment of bird use in the project area during the study period. In addition, three of the survey points had extended monitoring periods and focused on raptor activity.

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<sup>15</sup> Dr. David Drake, "Existing Wildlife Resources Review – Highland Wind Farm, LLC" and "Interim Report – February 1, 2012, Pre-Construction Bird and Bat Monitoring for Emerging Energies Highland Wind Farm in St. Croix County, Wisconsin" (presented in CPCN Application Appendix O, PSC ERF #160367, February 2012).

Almost all project construction would occur on active agricultural lands. Only a small amount of habitat other than agricultural lands would be directly disturbed by the project. Active agricultural lands provide feeding areas for some bird species during migration and winter but provide only limited habitat for nesting birds. The impact to bird habitat from direct habitat removal and from fragmentation of existing habitat would be relatively low. Construction activities to install the proposed wind turbines would likely temporarily disturb birds using areas near the active construction sites.

The avian study did not identify any heavily used local flight paths or any locations in the project area where bird activity was heavily concentrated. Rather there are wetlands and wooded areas that serve as local or small bird concentration areas with a greater bird diversity than the predominantly agricultural landscape.

The surveys recorded observations of 73 bird species. One state-listed threatened species was recorded, the cerulean warbler.

There were eight sightings of the state threatened cerulean warbler during the avian study. All sightings were on or after July 20th. The observations of the cerulean suggest that the species only occasionally make use of the project area. There were no observations in the avian study that would suggest any nesting activity in the project area. According to information on the DNR's Endangered Resources website, the Cerulean warbler inhabits:

“Mature mesic deciduous woodlands, including maple, basswood, and especially oak in both uplands and lowland or floodplain forests. Often found near small canopy openings in large continuous forest tracts; prefer medium and large tracts over small tracts (less than 40 acres).”

The construction proposed for the Highland Wind Farm is expected to remove about 0.3 acres of woodland and would not fragment any forest blocks. Construction of the proposed project is unlikely to degrade any potential nesting habitat for the cerulean warbler.

Thirteen other bird species observed in the project area are identified as Special Concern (SC) species in Wisconsin or listed as Species of Greatest Conservation Need (SGCN) in the DNR's Wisconsin Wildlife Action Plan (many identified as both). SC species are those species about which some problem of abundance or distribution is suspected but not yet proven. The main purpose of this category is to focus attention on certain species before they become threatened or endangered. SGCN species have low and/or declining populations and are in need of conservation action and are identified by the DNR to ensure priority treatment when conservation actions or programs are developed.

Three SC/SGCN songbird species, the dickcissel, bobolink and eastern meadowlark, are summer residents in the project area and inhabit grasslands and agricultural fields. The brown thrasher and field sparrow are SC/SGCN species that were observed in the project area during the nesting

season. The brown thrasher nests in hedgerows and along the shrubby edges of fields, farmsteads, and deciduous forests. The field sparrow nests in grassland areas where shrubs and small trees are starting to get established. The SC/SGCN red-headed woodpecker, which primarily inhabits savanna-like woodlands or open oak woodlands, was observed at two locations.

Almost all project construction would occur in agricultural fields. Disturbance to the open field and shrubby edge species from construction activities would occur due to adverse effects on suitable habitat during the construction period. About 28 acres of agricultural land would be permanently converted to access roads and crane pads. This acreage would be spread over a large area, with a small area lost at each of the 41 turbine sites. Overall, no large changes in habitat for open fields or shrubby edge habitats of the dickcissel, bobolink, eastern meadowlark, brown thrasher, field sparrow, or the red-headed woodpecker are expected from the proposed project.

Only one or two individuals of six SC/SGCN bird species were observed during the surveys suggesting they occasionally pass through the project area and are thus unlikely to be significantly impacted from the proposed wind turbines. These species are the blue-winged warbler, great blue heron, great crested flycatcher, northern harrier, ruby-crowned kinglet, and vesper sparrow.

Two nests of the SC/SGCN bald eagle have been located in the project area. One active nest is in the northwest quarter of the project area and is located within one mile of three possible turbine sites. The second active nest is in the far northwest corner of the project area and is about 2 miles from the closest potential turbine site. There is a potential for both disturbance to the nesting eagles and collision mortality.

Bald eagles are federally protected under the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act. The Eagle Act prohibits anyone from "taking" bald eagles. Among other actions, "take" includes disturbance of bald eagles.

Bald eagles were removed from the federal endangered species list in June 2007 due to sufficient population recovery. However, the protections under the Eagle Act continue to apply. The U.S. Fish and Wildlife Service (FWS) recently established a voluntary permit program to authorize limited take of bald eagles and golden eagles where take is associated with otherwise lawful activities. Most permits issued under the new regulations would authorize disturbance. In limited cases, a permit may authorize the physical take of eagles, but only if every precaution was taken to avoid physical take. The FWS uses eagle population information in determining how many permits may be issued in any locality. The FWS eagle permit process is new and how specific situations will be reviewed is still developing.

Highland is working with FWS to evaluate the potential impact of the proposed project on bald eagles. The evaluation is still in the preliminary stages. The FWS has not yet stated whether it

believes the project would have high, medium or low risk to eagles, which would affect whether or not the FWS would recommend that Highland apply for a permit.

### Bats

Bat mortality has exceeded bird mortality at most wind farms where post-construction monitoring of both has been conducted. Preliminary mortality rates at two Wisconsin wind projects indicate mortality levels well above the national average. Compared to many species of birds, bats are long-lived and have low reproductive rates, which may make their populations more vulnerable to wind turbine mortality than birds. Many American bat species are in decline. Overall, very few bat studies have been conducted in Wisconsin and thus bat numbers and behavior are not well understood.

A pre-construction bat activity study was conducted in the project area.<sup>16</sup> The study to date focused on acoustic surveys during the post-breeding and fall migration periods. The acoustic sampling showed that bats were present in the project area during the study period. It is certain that there will be some level of bat mortality if the proposed wind farm is constructed. The application states that Highland would conduct a one year post-construction bird and bat mortality study.

The study listed seven Wisconsin bat species that potentially occur in the project area. No species identifications, however, could be performed by the study. Four of the potential species are cave bats that are susceptible to white nose syndrome, a disease that elsewhere in the country has devastated local cave bat populations. While white nose syndrome is not yet present in Wisconsin, the DNR has classified the four cave bats as threatened to aid in dealing with the disease if it reaches Wisconsin. The DNR issued a “Broad Incidental Take Permit and Broad Incidental Take Authorization for Wisconsin Cave Bats.” Mortality of cave bats at wind turbines is allowed under the incidental take permit and no specific mitigation measures are required.

### u. Woods

Woodlands cover about 27 percent of the project area. Upland forests, primarily maple, oak, and pine, make up the majority of the project area’s woodlands (about 6,550 acres). About 620 acres of wooded wetlands, primarily ash, elm and box elder, are also present.

Almost all project construction would occur in agricultural and other non-wooded areas. Highland has estimated that about 0.3 acres of upland woods would be affected by construction of access roads. No other direct effects on woodlands are anticipated.

Collector cables crossing through wooded areas would be installed by directional boring. This technique installs the cables under a land feature without disturbing the surface. The bore would

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<sup>16</sup> Ibid.

start and end in drill pits excavated on either side of the woods and no surface disturbance would occur. The largest wooded area that Highland proposes to bore under is for the collector line between turbine sites 3 and 4. The HDD installation method avoids disturbance to about 0.3 wooded acres that would be necessary if typical surface-based installation method were used.

## **5. Conclusions**

Wisconsin Administrative Code § 4.20(2)(d) identifies ten broad factors that are useful to consider when evaluating whether an EIS is warranted for a given Commission action. The following subsections discuss each of the ten factors with respect to this case.

### **a. Effects on geographically important or scarce resources**

No significant effects are anticipated on geographically important or scarce resources. The proposed project would not affect archeological or historic sites, nor is it expected to affect any rare species or their habitats

### **b. Conflicts with federal, state, or local plans or policies**

The current Forest Town Board and the applicant are not in agreement regarding whether construction of the proposed project is appropriate and is compatible with the town's Comprehensive Plan, adopted in 2009. While the proposed project may not be consistent with the goals related to preserving the town's scenic open space and rural character, or the location of future industry and commerce, it is consistent with the plan's stated objectives related to encouraging renewable resource projects. It may conflict with current town of Forest zoning ordinances; however it is unlikely that they apply to this proposed project.

The proposed project does not conflict with any federal or state plans or policies.

### **c. Significant controversy**

The level of local public controversy is similar to that of other large wind farm projects that have been proposed in Wisconsin. It is expected that issues such as aesthetics, property values, shadow flicker, and noise will be commented on at the public hearing. The town of Forest board opposes this project and is a party in this docket.

There is an ongoing exchange of comments, particularly via internet sites, about health effects from wind turbine noise. Public health agencies from multiple states have reviewed known information and conclude that while there is annoyance and sleep disturbance attributable to wind turbines, the presence of other direct health impacts cannot be scientifically supported.

### **d. Irreversible environmental effects**

Generally, the construction and long-term presence of the proposed wind farm is not expected to result in any significant long-term environmental effects. Some long-term effects, such as loss of some productive agricultural land and changes in the local visual landscape, are expected to occur for the approximately 30-year duration of the project. Many construction effects, such as potential soil compaction of agricultural soils and increases in local traffic noise and congestion should improve when construction is complete.

#### e. New environmental effects

The proposed project would not result in any new types of environmental effects. The construction of other large wind farm projects has occurred in Wisconsin. None of the project's environmental consequences are expected to be fundamentally different from those of other wind farm projects that have been built in Wisconsin.

#### f. Unavoidable environmental effects

Construction of wind turbines, access roads, and cables would have some unavoidable effects, primarily on soils. Many of the soil effects would be temporary. The proposed project would change the appearance of the landscape, add a new source of noise, shadows and light pollution, and remove agricultural land from production. There would be minor environmental effects to wetlands, waterways, woodlands, and most wildlife. The project has the potential to change bird and bat use of the project area and to be a source of bird and bat mortality. Bird mortality is not expected to be significant due to the lack of rare birds or large concentrations of common birds in the project area. However, impacts on nesting bald eagles in the project area could occur.

#### g. Precedent-setting nature of the proposed action

Other wind farms have been reviewed and approved by the Commission. While this project would involve larger-sized turbines than at currently operating wind farms previously approved by this Commission, the proposed Highland Wind Project would not set any precedents.

#### h. Cumulative effects

The construction of multiple large wind farms in Wisconsin may have a negative cumulative effect on bird and bat populations, but it is not possible to predict the magnitude and significance of that effect at this time.

#### i. Foreclosure of future options

The construction of wind turbines in this largely agricultural area might hinder or prevent future development in the area. For example, additional residential developments might not occur due to the aesthetic changes to the landscape caused by this project, contractual setback requirements, and the additional revenue stream for farmers. Commission staff is not aware of

any options for long-term future electric system reinforcement or expansion that would be foreclosed by the proposed project or necessary if the proposed project were put in place.

#### j. Direct and indirect environmental effects

The direct environmental impacts of wind farm construction would include changes to the existing visual environment, and additional sources of noise and night-time light pollution. Soil erosion and runoff during excavation is a concern, especially near wetlands and streams. Construction in and through agricultural fields would result in the loss of some crops during the construction period and the permanent loss of 30 acres of agricultural land. Soil compaction in agricultural fields is a serious concern and can impact future productivity. The proper use of mitigation techniques can greatly reduce many direct impacts to both sensitive resources and agricultural operations.

The direct impacts of visual change, noise and shadow flicker from the new turbines would likely, for some residents in the project area, be considered a major degradation of the area's landscape. These residents may think the presence of the new turbines reduces their quality of life, especially if they moved out to the country to live in a relatively undeveloped agricultural environment or if they experience sleep disturbance from turbine noise.

The shared revenue dollars that would accrue to the county and township could have an indirect positive impact on services and the long-term economic status of the area.

## 6. Recommendation

The Highland Wind Farm Project proposes the construction of about 41 wind turbines within a project area covering 26,500 acres in northeastern St. Croix County. The potential local direct and indirect environmental effects of this project and methods to avoid or reduce those effects have been identified and discussed in this assessment.

About two-thirds of the project area is dominated by agricultural lands without exceptional topography or natural resources. Almost all project construction would occur on agricultural lands. Wind farm construction would cause temporary impacts to agricultural lands and a few small wetlands and waterways and some permanent loss of productive agricultural land. Less than one acre of woodland would be removed permanently for access roads. Proper construction and mitigation techniques could significantly reduce most anticipated environmental impacts. No areas with significant or unique environmental resources would be affected by project construction. No substantial land use impacts have been identified.

The wind farm would cause bird and bat mortality. The impact to bird habitat from direct habitat change should be minor, as most construction would occur on agricultural lands. No locations

with concentrated bird activity or heavily used local flight paths were identified in the project area. The proposed project does not appear to present a risk to any rare bird species.

The levels of shadow flicker and noise at non-participating residences in the project area appear to be similar to levels present at other wind farm projects previously built in Wisconsin. A few non-participating residents have expressed concern about reported experiences at these operating wind projects.

The visual changes, noise, and shadow flicker from the new turbines would likely be considered, by some residents in the project area, a major degradation of the area's landscape. These residents may think the presence of the new turbines would substantially reduce their quality of life, especially if they enjoy living in a relatively undeveloped agricultural landscape or if they experience sleep disturbance from turbine noise. It is expected that other individuals in the project area would not react negatively to the new turbines.

The Commission prepared an EIS for the WEPCO Glacier Hills project. At the time when the Glacier Hills project was under review the Commission was becoming aware of complaints from residents living near wind turbines that were part of recently constructed wind projects. The Glacier Hills EIS was prepared to help create a more complete record for that case, provide additional opportunity for public participation and bring the noise concerns and updated health-related information forward for detailed consideration by the Commission. Recently acquired results of several post-construction bird and bat mortality studies were also incorporated into the Glacier Hills EIS. That information and analyses have been incorporated into this EA.

One major additional review of the noise health effects issue has been completed since the Glacier Hills EIS. The main conclusions from the 2012 Massachusetts study are consistent with and reinforce the evaluation contained in the Glacier Hills EIS. There is no reason to believe that preparing an EIS for the current Highland wind project application would provide the Commission any substantially different information regarding the noise health effects issue from that contained in the Glacier Hills EIS.

☒ No significant impact. Environmental review complete. Preparation of an environmental impact statement is not necessary.

☐ Prepare an environmental impact statement.

Submitted by: Michael John Jaeger, Gas Policy Analyst  
Andrea Rainka, Environmental Analyst  
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Date: July 18, 2012

This environmental assessment complies with Wis. Stat. § 1.11, and Wis. Admin. Code § PSC 4.20.

By: Kathleen J. Zuelsdorff

Kathleen J. Zuelsdorff, WEPA Coordinator

Date: August 29, 2012